The Engineering News.

FEBRUARY, 1875.

Law and Legislation.

An abstract of decisions of the Supreme Court of the United States and of the courts of the various States in the Union upon questions relating to boundaries, surveys, etc.

218. Where in trespass to try title, the jury have disregarded, fixed and settled land marks, for a purely conjectural location, a new trial will be granted. *Ibid.*

219. A possession for 20 years of a part of the land in dispute, in reference to a line conflicting with another tract, of which another party may be also in actual possession, but outside of the disputed territory, may be enough to presume the execution of a deed conveying the land in dispute to the party in possession. *Ibid.*

220. Where a land certificate has been located, the power of the land office over the land is at an end, and a subsequent patent of the same land must yield to the certificate and location, though the patentee had no notice of it. Mayer v. McCullough, 1 Smith (Mo.), 211.

221. In such case, the party having equitable title may maintain a bill in Chancery, and obtain the legal title from the patentee or his voluntary grantee. *Ibid.*

222. A boundary on a fresh water pond, which had been permanently enlarged by means of a dam at its mouth, conveys the land as far as the low water mark of the pond in its enlarged state. Wood v. Kelley, 30 Maine, 47.

223. Lines were run by the grantees under two deeds of adjoining tracts of land, made at the same time, on which lines, with the intention of conforming to the location, they soon after established monuments, and continued to occupy accordingly, for more than twenty years. Held, that the distances named in the deeds must yield to such location. Mosher v. Berry, 30 Maine 83.

224. Held also that evidence was admissible to show that the location was made in conformity with an established custom and usage, existing at the time of giving a particular measure, in locating the territory in question. *Ib.*

225. Whether a lot of land bounded on a lake, is limited to the margin of the lake or not, depends on the manner in which the lake was formed. Dillingham v. Smith, 30 Maine, 370.

226. Under a devise of a lot of about one acre of land, be it more or less, adjoining land of B, and land of W. it was held that the devisee took the whole lot, although it was nearly ten acres. Bear v. Bear, 13 Penn. State Rep. 529.

227. A bank is the continuous margin where vegetation ceases, the shore is the sandy space between it and low water mark. McCullough v. Wainright, 14 Penn. State Rep., 171.

228. Evidence is admissible to determine a disputed boundary, that a certain tree was the corner between one of the parties and a third person on the side of the tract opposite to that in dispute. Mills v. Buchanan, 14 Penn. State Rep., 59.

229. Fixed boundaries, such as marked trees, must prevail over courses and distances when they differ. *Ib.*

230. A and B owned adjoining tracts of land, A claiming under a warrant dated July 23, 1773, with survey dated Dec. 9th, 1773, and B claiming under warrant of same date, with survey dated Dec. 10th, 1773. A claimed to a chesnut oak found on the ground at the distance named in the survey, and B claimed to a white oak on the opposite side of the survey. Both of these trees were proved to be original corners. It also appeared that in 1774. a chesnut was marked by the surveyor on the line claimed by B, and that this was much short of the distance named in the former surveys. Held, that as the survey of 1774 was so ancient, and the corners claimed by A would destroy all the surveys, the Court could not disturb the line and corners fixed in 1774. Wray v. Miller, 14 Penn. State Rep. 289.

231. Where a corner tree could not be found at the end of the declared distance, which was shown to have been recognized by the grantors of both parties as the corners, more than fifty years before; it was held that it was properly left to the jury to find whether the monuments or the measurements should govern, and they having found for the measurements, the judgment was affirmed. Icehour v. Rives, 10 Iredell (N. C.), 256.

232. Where a corner was described as being on the last side of a creek, and there was evidence tending to show that it was on the west side of the creek, it was held to be a question for the jury to decide on which side the corner was located. Hanser v. Belton, 20 Iredell, 358.

233. The end to be arrived at by all the rules of location is to established for the plaintiff, in an action to try the title of land, the lines run or described in the grant he produces, where such a monument of title is produced, elder and therefore paramount so far as the evidence may permit, and as law or adverse proof may overrule. But when a plaintiff comes into the Court with a grant and plat. which, though older, is obscure, either from its not being actually surveyed, or from some other carelessness, he cannot demand that the doctrine that the elder grant is to be more favorably located, should be strained to meet his case. Faulkenberry v. Truesdell, 5 Strobhart (S. C.), 221.

234. Where one enters upon wild lands and marks out boundaries with the intention of taking possession, he takes a possession co-extensive with the boundaries so marked. Campbell v. Thomas, 9 B. Mon. (Ky.), 82.

235. A certain agreement between those who owned the land bounded was admitted as evidence of the boundary line named therein against those who claimed under one of the parties to the agreement, and was held to be binding on them. Orr v. Foote, 10 B. Mon. (Ky.), 387.

236. Monuments found at the two extremes of a township line are entitled to no more controlling influence in determining the actual location of an intermediate line, than the section corners established along the line. But all original monuments, established in connection with the field notes and plats must be referred to in order to define the locality of the line. McClintock v. Rogers, 11 Ills. 279.

237. Quantity, although the least reliable and the last to be resorted to of all the descriptions in a deed, in determining the boundaries of the premises conveyed, may sometimes be considered in corroboration of other proof. *Ibid.*

Technical Education.

An employee of a law court, however familiar he may be with the ordinary details of legal business, is not usually considered qualified to practice as an attorney; and a hospital nurse may be the attendant of a physician or surgeon in his daily rounds, throughout a life time, and yet not be considered a fit person to write a prescription or set a broken finger. People with grievances to relate or bodies to be healed, go to neither one nor the other for advice or medicine, and should either presume to practice in these professions on the strength of his "practical" knowledge, he would at once be dubbed a "shyster" or a "quack," whose patrons must come from the ignorant and disreputable classes of community.

But in the mechanical arts—notably that of construction—the practical man has from time immemorial held high court. From the days of Plato and Archimedes until quite recently, it has been the practice for *savans* to look with considerable disdain upon the application of pure science to purposes of public utility, and although many of the great phllosophers of bygone days *did* give the State the benefit of their superior knowledge, yet this condescension on their part was generally looked upon as a lowering of the dignity of science.

On the other hand, it was the fashion to describe scientific men as visionary; engrossed in the contemplation of finely spun theories, very beautiful in themselves, but unsafe for use; absent minded; and in general, totally unreliable and unfit for the practical affairs of every day life.

It is respecting the evil influence of this supposed inconsistency between theory and practice, that the late distinguished Prof. Rankine of Glasgow University, thus writes:

"It is in the practice of mechanics and engineering that the influence of the great fallacy is most conspicuous and most fatal. There is assuredly, in Britain, no deficiency of men distinguished by skill in judging of the quality of materials and work, and in directing the operations of workmen,—by that sort of skill, in fact, which is purely practical, and acquired by observation and experience in business. But of that scientifically practical skill which produces the greatest effect with the least possible expenditure of material and work, the instances are comparatively rare. In too many cases we see the strength and the stability which ought to be given by the skillful arrangement of the parts of a structure, supplied by means of clumsy massiveness, and of lavish expenditure of material, labor and money; and the evil is increased by a perversion of the public taste, which causes works to be admired, not in proportion to their fitness for their purposes, or to the skill evinced in attaining that fitness, but in proportion to their size and cost.

"With respect to those structures which, from unscientific design, give way during or immediately after their erection, I shall say little, for with all their evils they add to our experimental knowledge, and convey a lesson, though a costly one. But a class of structures fraught with much greater evils exist in great abundance throughout the country, namely: those in which the faults of an unscientific design have been so far counteracted by massive strength, good materials and careful workmanship, that a temporary stability has been produced, but which contain within themselves sources of weakness, obvious to a scientific examination only, that must inevitably cause their destruction within a limited number of years.

"Another evil, and one of the worst which arises from the separation of theoretical and practical knowledge, is the fact that a large number of persons, possessed of an inventive turn of mind and of considerable skill in the manual operations of practical mechanics, are destitute of that knowledge of scientific principles which is requisite to prevent their being

misled by their own ingenuity. Such men too often spend their money, waste their lives, and it may be lose their reason, in the vain pursuit of visionary inventions, of which a moderate amount of theoretical knowledge would be sufficient to demonstrate the fallacy; and for want of such knowledge, many a man who might have been a useful and happy member of society, becomes a being than whom it would be hard to find anything more miserable."

But a brighter day has dawned, and in the general diffusion of knowledge that distinguishes the present century, and more especially the last quarter thereof, the relations between the men of science and the men of practice have been recognized, and the mutual dependence on each other acknowledged. In the principal countries of Europe there have been for many years schools for the scientific training of young men to the professions of Civil, Mechanical, and Mining Engineers, under whose direction most of the recent great engineering works of these countries have been constructed together with the development of the mineral resources and the consequent promotion of industrial activity.

The Government of the United States has, from its foundation, been especially liberal in the support of educational institutions. When the public land system was under discussion in 1785, not a single dissenting voice was raised upon the question of setting aside section 16 for school support, and from that time until the admission of Oregon as a State, in 1859, one thirty-sixth of the entire public domain, as rapidly as it was formed into states and territories, was set off for educational purposes; at that time, the quantity was duplicated, and ever since, in the formation of new states and territories, one eighteenth of the area or sections 16 and 36 of each township, are thus donated; furthermore, for the endowment of educational institutions of a higher grade, at least two townships, or seventy-two square miles, have been granted to each new state, besides special grants that have also been made to private enterprises.

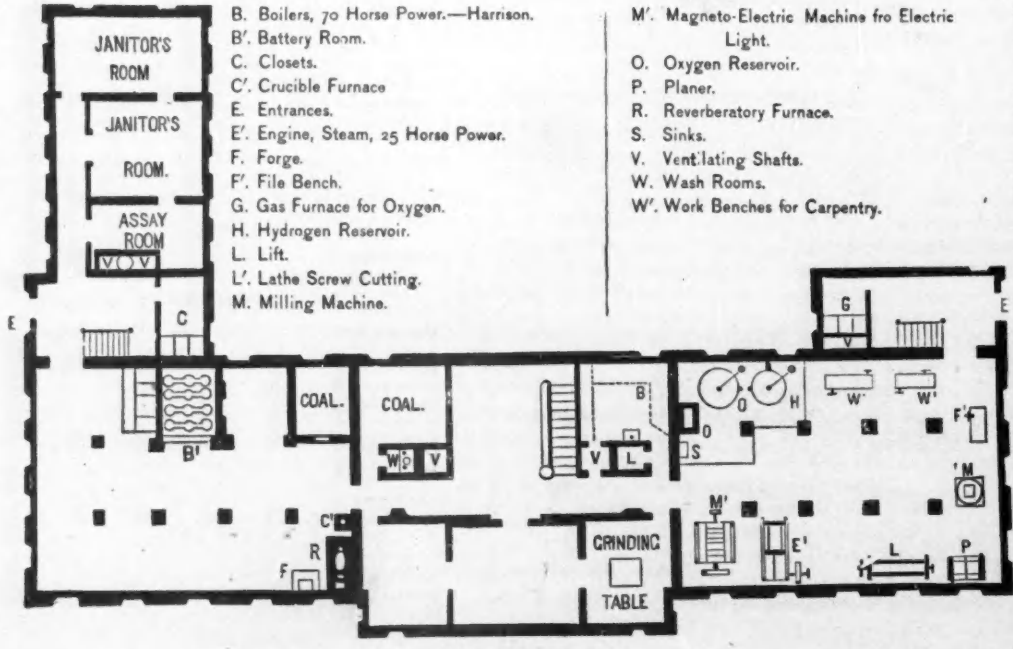
By the act of July 2, 1862, our educational endowment system was enlarged by the donation to each State of 30,000 acres of public land for each senator and representative to which it was entitled under the apportionment of 1860, for the support of colleges for the cultivation of agricultural and mechanical science and art. The total amount of these endowments up to the year ending June, 1869, sum up 79,576,704 acres, or 124,323 square miles, a larger surface than the united areas of Great Britain and all the surrounding islands in the English seas. If any of our readers wish to know how this princely endowment was distributed they can find it in the Report of the U. S. Land Commissioner for 1869, who takes it from the Report of the Superintendent of Schools of Missouri, for 1868.

But while Government has thus liberally assisted in the support of public schools, and of higher educational institutions, it has been most nobly supplemented by the munificent gifts of private individuals, and now this country can point to schools, either separate, or attached to various colleges, for the training of young men in technical education, that are not surpassed by those of any other land. With the names of Girard, Cooper, Cornell and some others, all are familiar; a later name is that of Edwin A. Stevens, Esq., to whose liberality the country owes the Stevens Institute of Technology at Hoboken, N. J., to which institution we propose to devote the remainder of this article.

PLATE II.

Stevens Institute of Technology.

B. Boilers, 70 Horse Power.—Harrison.
B'. Battery Room.
C. Closets.
C'. Crucible Furnace
E. Entrances.
E'. Engine, Steam, 25 Horse Power.
F. Forge.
F'. File Bench.
G. Gas Furnace for Oxygen.
H. Hydrogen Reservoir.
L. Lift.
L'. Lathe Screw Cutting.
M. Milling Machine.
M'. Magneto-Electric Machine fro Electric Light.
O. Oxygen Reservoir.
P. Planer.
R. Reverberatory Furnace.
S. Sinks.
V. Ventilating Shafts.
W. Wash Rooms.
W'. Work Benches for Carpentry.



BASEMENT.

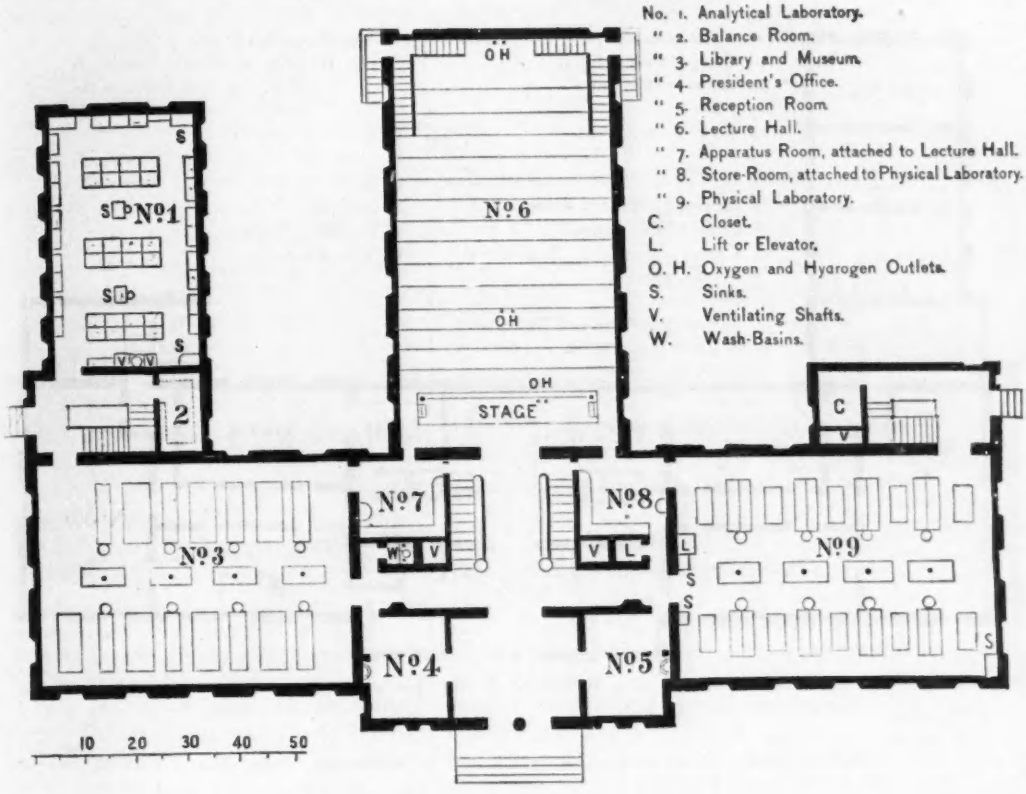
By his will, dated April 15th, 1867, Mr. Stevens donated $650.000 and a lot of ground (425×200 ft.), in Hoboken, N. J., for the foundation and establishment of "an Institution of Learning," leaving it to the discretion of his trustees to determine the particular character of said institution. The trustees, in view of the existing needs of the country at large, and of the personal interest always manifested by Mr. Stevens in the development of the mechanic arts, determined that the Institution of Learning should be a school of Mechanical Engineering.

By his will, Mr. Stevens directs that the tuition is not to be wholly free, but the proportion of payment by each pupil shall be left to the discretion of the acting trustees.

For the plan of instruction,—which combines in an eminent degree the mutual benefits of theory and practice,—we refer our readers to the "Announcement of the Institute" for 1874. For the exterior appearance and the interior arrangement of the building, we refer to the accompanying plates. The collections for conducting experiments in illustration of the various studies pursued, are too extensive to be enumerated.

PLATE IV.

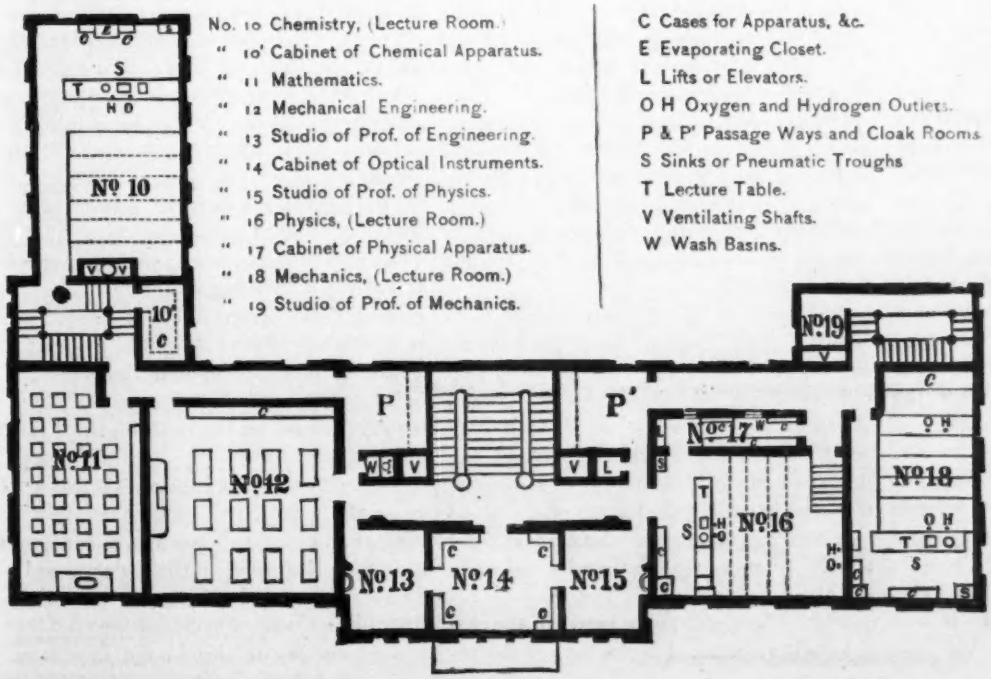
Stevens Institute of Technology.



FIRST FLOOR.

PLATE V.

Stevens Institute of Technology.



SECOND FLOOR.

The faculty are composed of men whose names are familiar to the engineering profession, and to the readers of the scientific journals of the day.

Aside from their onerous duties in the class room, most of them are engaged in independent researches in some branch of physical science, thus helping to obtain some credit for this country for original investigation in science, of which, according to Prof. Newberry, it sadly stands in need.

Dr. Morton, the President, who in chemistry, is the fortunate discoverer of Thallene, is engaged in important investigations in the subjects of electricity and fluoresence. Prof. Mayer's researches in accoustics have been fruitful of important discoveries, and in magnetism and other branches, he has been equally well rewarded.

Prof. Leeds, always at work on something important in chemistry, is now engaged, in connection with Prof. R. H. Thurston, in a research looking towards the determination of the correllation of the chemical constitution, and the physical and mechanical properties of iron and steel.

Prof. DeVolson Wood is revising his published works on "Resistance of Materials," and on "Bridges and Roofs," and in experimenting with his newly invented "Rock Drill."

Prof. R. H. Thurston, with whose name the history of Mechanical Engineering in this country, is familiarly associated for years past, has been engaged upon his new autographic machine, (of which an illustration will be given in a future number of this journal) and in those researches which only a strain diagram can facilitate

His services are also constantly in demand for the investigation of various new inventions, in testing steam machinery, etc., besides the regular work of the mechanical laboratory of the Institute.

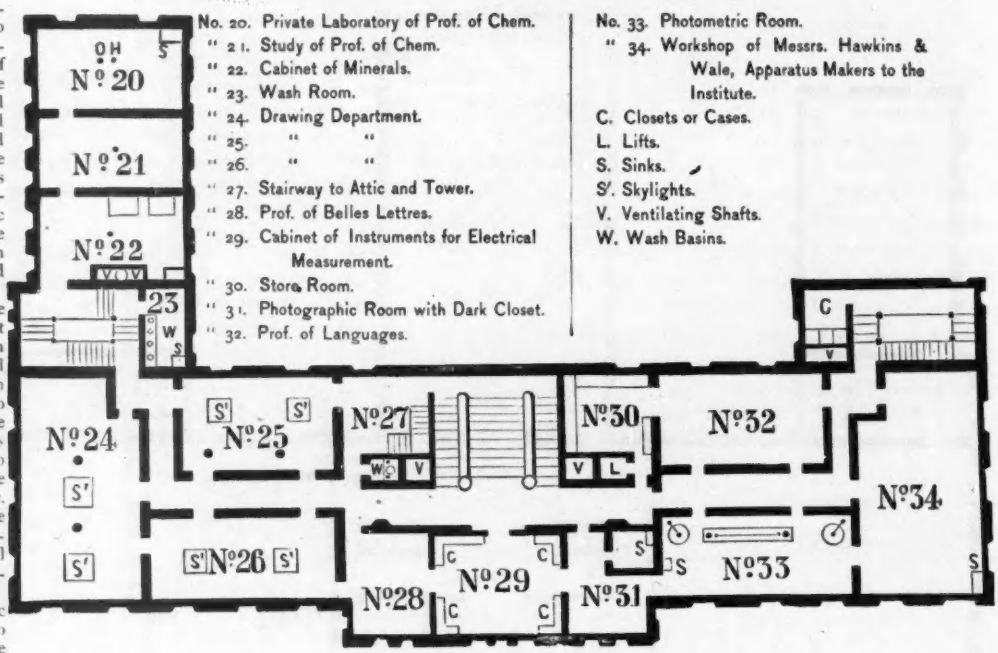
In these various investigations the students assist. They have aided at the trial of engines, boilers, pumps, and other machinery; at the Fair of the American Institute, in 1871, they assisted in testing steam boilers, and each year since have aided at tests of reciprocating and rotary engines there and elsewhere; at the trial of road locomotives and road rollers at South Orange in 1872, and have recently aided in determining the duty of waterworks machinery and in other very interesting work.

In the Drawing Rooms the older students are designing small steam engines and boilers, Wood's rock drills, testing machines, philosophical apparatus, etc., etc.

The class entering this last term (class of 1878) was about 60 in number—altogether too large to be as well taken care of as could be wished, and it is proposed next year to raise the standard of admission by greater stringency in examination, and to make the price of tuition pretty nearly equal to that of other technical schools—probably about one fourth the actual cost of instruction, the expenditures being about $40,000 over and above students' fees and interest in cost of buildings and grounds.

PLATE VI.

Stevens Institute of Technology.



THIRD FLOOR.

The Mechanical Laboratory is being enriched by the liberal donations of friends of the enterprise and of manufacturers generally. It has a Riehle-Testing Machine of a capacity of 40,000 pounds, and also two autographic Testing Machines producing strain diagrams, the one a scale of 30,000 pounds per square inch, the other of 24,000 pounds per inch, and indicating on test pieces of standard size stress as high as 225,000 lbs., and 120,000 lbs. These machines are being made to order in the workshops of the Institute, where also are manufactured philosophical apparatus, magic lanterns, and other apparatus for the use of schools and colleges, of which several institutions have already availed themselves.

We have devoted considerable space to this subject because we consider it a very important one. The Institution of which we have written is devoted mainly to giving instruction in Mechanical Engineering; attached to most of the principal colleges in the United States and Canada are schools of civil engineering; there are also separate engineering schools that are well known throughout the country. To these several Institutions we propose from time to time to devote our attention, and will be pleased if they will send us their annual catalogue or announcement as each is issued.

Of the grand results of this scientific training of the engineers who are to direct the construction of the future public works of this country, and also of other countries, we cannot but feel hopeful and believe that in this close unity of theory and practice we are rapidly raising the standard of engineering to its proper elevation among the learned professions.

The Rochon Micrometer Telescope as a Surveying Instrument.

BY ROBT. BELL, C. E., F. G. S., OF THE GEOLOGICAL SURVEY OF CANADA.

Written for the Engineering News.

In attempting to map out the geographical distribution of the rock formation in the out-lying and unexplored districts of the Dominion of Canada, it becomes necessary for the geologist to make pretty extensive topographical surveys. These surveys have hitherto been carried on principally in the wooded regions. For geological purposes straight lines are not required, as in subdividing the land, and if we know our positions with sufficient accuracy, it does not matter how we have ascertained them. We have, therefore, found it more convenient to follow the water courses or canoe-routes over the principal rivers and lakes; the surface of the water affording a clear space for the use of instruments for ascertaining distances without chaining. The shores of large lakes are most quickly and accurately done by triangulation, using one of Troughton's Reflecting Circles or a Theodolite or Sextant, for taking the angles. It was in this way that I surveyed such lakes as Nipigon and Long Lake, north of Lake Superior. But in rivers and small and narrow lakes, we adopt another quick and easy method for finding the distances from point to point.

Rochon's Micrometer Telescope has long been used for this purpose, and is well adapted for making surveys in a new or rough country; it is also a useful instrument for some astronomical purposes, and in military and naval operations. Although it was invented by M. Rochon, in the beginning of the century, it is still comparatively little known. Almost all our land surveyors to whom I have shown the instrument have sent for it, and find it very useful for putting in the shores of lakes or islands, instead of working by straight lines and offsets.

It consists of an ordinary telescope, to which is added a contrivance for measuring the angle, subtended at the eye by two objects whose distance apart is known. As these angles are all very small—say less than 30′—the difference between the line and tangent is not appreciable in practice, and knowing the length of our fixed base and the subtended angle in a right angled triangle, we may easily calculate the other side, which is the distance required. The small angle between the two objects is ascertained by means of the refraction of the rays of light in passing through two prisms, made from a quartz crystal, one being cut parallel to the axis and the other to one of the faces of the pyramid of the crystal. These are placed close together and fixed in a rack or cylinder, which is made to move up and down inside the telescope-tube by means of a knob or mill-headed screw passed through a slit running nearly through the whole length of the tube. The tube of a telescope of convenient size for surveying purposes is about 20 inches in length, but for finer work, and for astronomical purposes it may be double this length, and should have a magnifying power of not less than fifty. One side of the slit is divided into from 30 to 40 equal parts, each to represent only one minute of a degree; each of these again into six parts, each representing 10 seconds; and by means of a little vernier carried along with the cylindrical rack enclosing the prisms, single seconds can be easily read by the naked eye.

When the vernier is placed at the zero point of the scale the instrument may be used as an ordinary telescope. But if we slide the prism rack up the scale we notice a new object gradually grow out of the first, like a ghost of itself. By continuing to push the prisms this image may be en

tirely separated from the real object, provided its diameter be not too great. When the one has passed across the face of the other, and their opposite edges just touch, the reading on the scale gives the angle which the object subtends at the eye, and if we know its diameter we have the means of ascertaining its distance.

The late Mr. W. H. Jones of Charing Cross, London, England, who manufactured excellent Rochon Micrometers, published a very convenient table, (which may be had in Montreal), giving the distances in feet, corresponding to every angle from 1″ up to 38′, supposing the object to be one foot in diameter. If the object were a yard in diameter, of course the figures in the table would become yards, and so on. I have adopted a convenient method of getting the distance at once from this table in chains and links. This consists in placing the two targets or discs on a staff at exactly 6.6 feet apart, and then always moving the decimal point in the table one place to the left—equivalent to using a one foot target and dividing the number given in the table by 66. If the target be made a foot in diameter and painted white with a black horizontal line and a black centre six inches in diameter, they can be used with accuracy at a distance of upwards of half a mile. For greater distances the targets should be placed at double or treble this distance, or still further apart, when, of course, the number found in the table would be multiplied by 2, 3, &c. In order to measure long distances I have frequently had the branches lopped off a straight pine or spruce tree, and white boards nailed across the trunk at 33 or 66 feet from the upper edge of the one to that of the other.

The discs or targets used, should always have a good deal of white about them and a dark colored back ground with a good light upon it should be chosen, if possible, for each station, so that the discs may be the more distinctly seen by the contrast.

When the distance is so short that the 6.6 base gives too large an angle for the instrument to measure, a single disc may be taken as a one foot base, or if this still be too great, the six inch centre can be used, and the distance as given in the table divided by 2.

The directions of the lines may generally be taken with sufficient accuracy for most purposes by means of a prismatic or other compass, and their true bearings ascertained by meridians laid down by the pole star at night. An observation should also be taken for latitude once a day, either by the sun or pole star.

I have surveyed thousands of miles by this method during the last fifteen years, and whenever the work has been checked by subsequent surveys, it has been found sufficiently accurate. The distance per day, including portaging, &c., which can be done, usually varies from 5 to 10 miles, but under very favorable circumstances, I have accomplished as many as 30 miles. The survey is made in two boats or canoes, one carrying the disc and the other the micrometer. If the canoe with the disc be ahead, as soon as the observation is taken, a signal is given from that with the micrometer, when it moves on and takes up another station, and the second canoe moves to the place which had been occupied by the first. The micrometer is now held over the spot on which the disc had stood. In this way a river is surveyed from bend to bend, or a lake shore from point to point. In order to keep the best light on the disc it may be necessary in the afternoon to reverse the order followed in the forenoon, and keep the canoe with the disc behind. Care should be taken that the disc staff be held vertically, and stations selected with a view to the next sight as well as for the one in hand. The discs may be made of thin boards, tinned or zinced iron, and are better to be fastened to a stout, square staff, with screws from the front, than by means of clamps.

Two other instruments for measuring distances without chaining, are very highly spoken of for accuracy by those who have used them. These are the Telemeter of Mr. Adie, of the Strand, London, Eng., and Eckhold's Patent Omnimeter, manufactured by the Messrs. Elliott Brothers, of No. 449, of the same street.

MONTREAL, January, 1875.

Drawing Instruments.

HOW TO BUY

Persons with limited means will find it better to procure good instruments separately of any respectable makers, as they may be able to afford them, than to purchase a complete set of *inferior* instruments in a case. With an idea of economy, some will purchase second-hand instruments, which generally leads to disappointment, from the fact, that inferior instruments are manufactured on a large scale purposely to be sold as second-hand to purchasers—principally from the country, who are unacquainted with the workmanship of the instruments and of the system practised.

Inferior instruments will never wear satisfactorily, whereas those well made improve by use, and attain a peculiar working smoothness. The extra cost of purchasing the case and the nearly useless scales, would, in many instances, be equal to the difference between a good and an inferior set of instruments without the case. Further, if the case be dispensed with for economy, the instruments may be carefully preserved by merely rolling them up in a piece of wash leather, leaving space between them that they may not rub against each other.

THE METALS generally used in making drawing instruments are brass, electrum, or silver: the points and joints being made of steel. Silver is little used of late years, being costly and possessing little merit over electrum, which is at present the most popular. Electrum, *as it is called*, should be an alloy, composed of pure nickel and copper; in color it should be nearly equal the whiteness of standard silver, and be both harder and of less specific gravity. Its merit over brass is that it will not soil the fingers by forming verdigris from the action of the perspiration of the hand: neither does it emit the odor peculiar to brass, which is very disagreeable to some few sensitive persons. Electrum of inferior quality approaches the color of brass.

BY FINISH is understood the grace and correspondence in form of each side of the instrument, and the quality of the surfaces—which should be perfectly flat, or straight, in one direction, producing equally sharp angles. The grain left from finishing the surface should be at right angles with the length of the instrument; it should, in all parts, show an equal and very fine grained surface, but not a burnished gloss.

Kepler's Laws.

1. The planets move in ellipses, having the Sun in one of the foci.
2. The planets describe equal areas in equal times.
3. The squares of the Periodic Times of the planets are proportional to the cubes of their mean distances from the sun.

Astronomical Definitions.

The *Latitude* of a place on the earth's surface is its angular distance from the equator, measured at the centre of the earth

A *Parallel of Latitude* is a small circle parallel to the equator.

The *Meridian* of any place is the circle passing through that place and the axis of rotation of the Earth, and intersects the equator at right angles.

The *Horizon* of any place is the tangent plane to the earth at that place.

A line drawn perpendicular to the horizon will intersect the visible hemisphere in a point called the *Zenith*.

The same line produced below the horizon will intersect the invisible hemisphere in a point called the *Nadir*.